

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 March 2004 (04.03.2004)

PCT

(10) International Publication Number  
**WO 2004/018233 A1**

(51) International Patent Classification<sup>7</sup>: **B60B 33/08**,  
A63B 22/06

(21) International Application Number:  
PCT/AU2003/001054

(22) International Filing Date: 19 August 2003 (19.08.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
2002950873 20 August 2002 (20.08.2002) AU

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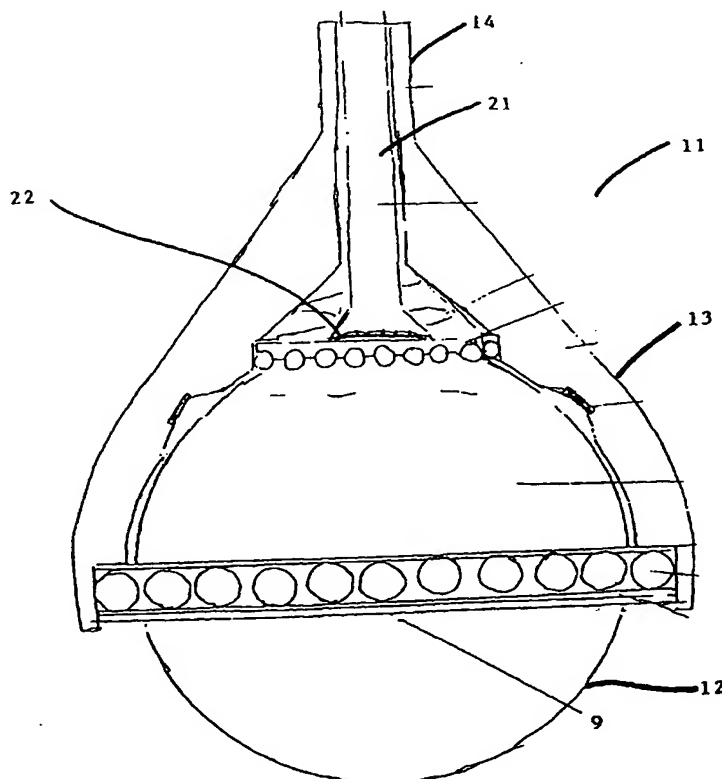
(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:  
— with international search report

[Continued on next page]

(54) Title: A DEVICE FOR PROVIDING MULTI-DIRECTIONAL MOVEMENT



(57) Abstract: A device, eg ball castor (11), providing multi-directional movement comprising a housing (13) having at least one rolling member located partially their. eg ball (12) Bearing means comprising sets of ball bearings held in annular races transmit the load of a trolley, etc carried by the device to ball (12) and also act to centre ball (12). A brake having pad (22) is urged against the top of ball (12) by a screw or spring to resist rolling movement of ball (12).

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

A DEVICE FOR PROVIDING MULTI-DIRECTIONAL MOVEMENT  
FIELD OF THE INVENTION

The present invention relates to mechanical devices which are movable such as wheels.

5 BACKGROUND OF THE INVENTION

The problem with many wheels is that they lack multi-directional movement. For example a castor wheel of a shopping trolley, although technically able to move in many different directions is frequently difficult to move in the direction the person pushing the trolley, wishes to move.

Much of the problem with the above castor wheel is associated with pushing of the trolley rather than pulling of the trolley. Because the castor wheel is actually only able to rotate in one plane, its multi-directional movement depends upon rotation of the shaft to which it is connected.

In a similar fashion articulated joints frequently are limited to movement in one plane in a similar fashion to a typical hinge.

20 SUMMARY OF THE INVENTION

The present invention provides an alternative device for providing multi-directional movement comprising a housing having at least one roller located at least partially within the housing, at least one bearing means for supporting a load and configured to couple the at least one roller with the housing whereby at least one roller is able to rotate relative to the housing and a braking means for providing resistance to rotation of the at least one roller.

30 It is preferred that the bearing means comprises a plurality of balls or rollers.

It is to be understood that the word "couple" is intended to include transferring of load from the housing to the roller.

35 It is preferred that the device includes a single roller.

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The roller may be a spherical ball or a cylindrical roller bearing or other roller bearing.

Preferably the braking means comprises a braking member which is configured to be urged into contact with  
5 the roller.

The bearing means may include an urging means for urging the braking member in a predetermined direction.

Preferably the braking member comprises a brake pad or equivalent.

10 The at least one bearing means is preferably located substantially above a major portion of the roller.

Preferably the braking member is located above the roller bearing means.

The braking member may be configured to contact a  
15 top surface of the roller.

The braking means may be operable to vary the amount of braking force applied to the roller.

The urging means may be operable to apply a predetermined force to the braking member.

20 The urging means may comprise a spring.

Preferably the bearing means comprises a race and a plurality of roller bearings located therein.

The braking member may be able to be forced by the urging means through the race into contact with the  
25 roller.

Preferably the urging means comprises a screwable member.

The screwable member may extend vertically through a top section of the housing.

30 The housing preferably includes a shank and a socket portion for the roller.

The screwable member is preferably controlled by a horizontal screw through a side wall of the housing.

The housing may comprise a tubular portion  
35 configured to receive the roller.

The tubular portion preferably has a plurality of stepped regions on its inner surface.

The device preferably includes a centring means for reducing frictional contact between the roller and an adjacent inner peripheral surface of the housing.

5 The centring means may comprise a peripheral race with a plurality of roller bearings configured to contact a circumferential or peripheral portion of the roller.

It is preferred that the device includes a retaining means for retaining the centring means in position around the peripheral portion of the roller.

10 Preferably the retaining means comprises a circlip.

The housing may include a first annular region which houses the centring means.

15 It is preferred that the housing includes a second region which houses the bearing means.

Preferably the second annular region has a smaller radius than the first annular region.

20 The top bearing means preferably comprises an annular member having a plurality of openings in which support rollers are located for contacting an upper surface of the or each roller.

25 The or each one of the support rollers may be adapted to be seated in the openings so that part of their surfaces protrude downwardly beyond the outer lower surface of the annular member.

Preferably the openings each comprise a hole through the annular member, which has a diameter which reduces in size to a minimum, which is less than the width of the roller bearing located therein.

30 It is preferred that each roller bearing when located in a respective hole protrudes beyond top and bottom faces of the annular member.

The housing preferably has a vertical shaft through which the urging member is located.

35 The housing may comprise a socket with an elongate portion extending axially from its top surface and the roller located in its open bottom surface.

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According to an alternative embodiment the device comprises a plurality of rollers each having one bearing means.

It is preferred that the device comprises four  
5 rollers with each roller having a bearing means contacting a top surface thereof.

Preferably the device includes a central power transfer means with the rollers equispaced therearound.

The device preferably includes a peripheral race  
10 with bearings which are configured to contact outer surfaces of the rollers.

The central power transmission means may comprise a drive shaft or ball.

Each roller may be located in a recessed area and  
15 confined to rotation within that recessed area.

It is preferred that the roller is able to move in any direction.

Preferably the roller provides universal movement for the device.

Preferably the housing comprises a tubular sleeve  
20 located around the shaft.

According to another embodiment the roller includes a central bore with an axle therethrough.

The device may include a plurality of bearing  
25 means.

Preferably the device includes left and right side bearing means.

Each left and right side bearing means preferably comprises an annular member having roller bearings housed  
30 in equispaced holes thereof.

The device preferably includes left and right centring means located on opposite sides of the roller.

It is preferred that the braking means is located above and/or below the roller.

The braking means preferably includes a spring.  
35 The roller may be a cylindrical roller bearing.  
According to one aspect of the present invention

there is provided an apparatus having a housing with at least one roller located at least partially within the housing, at least one bearing means for supporting a load and configured to couple the at least one roller with the housing whereby at least one roller is able to rotate relative to the housing and braking means for providing resistance to rotation of the at least one roller.

According to another aspect of the present invention there is provided an apparatus comprising a housing having at least one roller located at least partially within the housing, at least one bearing means for supporting a load and configured to couple the at least one roller with the housing whereby at least one roller is able to rotate relative to the housing with the bearing means comprising a plurality of rollers.

It is preferred that either of the above apparatuses have one or more of the preferred features hereinbefore described.

According to another aspect of the present invention there is provided a coupling means incorporating a device for multi-directional movement including one or more of the previously recited optional features.

According to one embodiment there is provided an exercise bike including the device with a cylindrical roller and the left and right side bearing means.

According to a further embodiment there is provided an apparatus having a joint incorporating the device.

According to a further embodiment the braking means comprises an electromagnetic which is able to apply a magnetic field to the housing to restrict or prevent movement of the roller.

It should be understood that multi-directional movement includes rotational movement, movement in a forward and reverse direction and linear movement.

The words "comprising, having, including" should be interpreted in an inclusive sense, meaning that

additional features may also be added

#### BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a front sectional view of a device for providing multi-directional movement in accordance with a first embodiment of the present invention;

Figure 2 shows disassembled components of the device shown in Figure 1;

Figure 3 shows a bottom view of a device for providing multi-directional movement according to a second embodiment of the present invention;

Figure 4 shows a top sectional view of a device for providing multi-directional movement according to a third embodiment of the present invention; and

Figure 5 shows an angled view of the device shown in Figure 4.

#### DETAILED DESCRIPTION OF THE DRAWINGS

As shown in Figure 1 a device for providing multi-directional movement is shown in the form of a castor wheel 11. The castor wheel consists of a spherical ball bearing 12 located within a housing 13 having an inverted cup shape with an upper apex extending into a vertical shank 14.

As shown in Figure 2 the inside of the housing 13 is provided with an axial shaft 15 through the centre of the shank 14 which opens into a lower hemispherical chamber 16 for receipt of the roller 12.

The hemispherical chamber 16 includes an upper recessed circular region 17 for receipt of a race 18. This circular region 17 is coaxial with the shaft 15 and a second recessed circular region 19 at the mouth of the chamber 16.

The second recessed circular region is located approximately at the equatorial region 19 of the hemispherical cavity 16 and consequently has a much wider



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width or diameter than the circular region 17.

The second circular region 19 is configured to receive a large race and bearings 20.

In this embodiment the central shaft 15 flares  
5 outwardly at its lower end into the first circular region 17.

As shown in Figure 1 the spherical ball 12 is located so that approximately less than half of its surface area is exposed below the bottom of the housing  
10 13.

A top region of the ball 12 rests underneath the first race and bearings 18 and is able to move in any direction with respect to the bearings of that race.

The second race and bearings 20 located around  
15 the equatorial region of the ball 12 helps provide centring of the ball 12 and prevents the surface of the ball adjacent the inner wall of the housing 13 from contacting this wall.

The race and bearings 18 and 20 enable the ball  
20 12 to freely move in any direction with minimal friction. Furthermore they enable the ball 12 to be housed within housing 13 without contacting its inner surface.

If a castor wheel having the features of the device shown in Figures 1 and 2 were used instead of  
25 existing castor wheels a shopping trolley for example would be able to move in any direction with minimal resistance to any force applied to the shopping trolley.

Likewise if the wheels were used in connection with a walking frame for a disabled person similar  
30 movement would be possible. In some cases however it is desirable to provide at least some resistance to movement to avoid uncontrollable movement of an article supported by the wheels.

The device therefore includes a braking mechanism  
35 consisting of a vertical rod 21 located through the shaft 15. The lower end of the rod 21 flares outwardly and incorporates a braking pad 22 or equivalent on its lower

surface. By moving the member 21 downwardly the brake pad is forced downwardly through the race and bearings 18 into contact with the top surface of the ball 12. Depending upon the amount of contact between the brake pad and the ball 12 a variable amount of resistance to movement can be applied to the ball 12.

The braking mechanism may also be located through the other part of the housing and may include more than one member 21. Furthermore the brake pad may be replaceable and may contact a different part of the ball 12.

A screw mechanism may be used to change the amount of contact between the braking mechanism and the ball 12. Alternatively the braking mechanism may incorporate a spring which naturally urges the member 21 downwardly into contact with the ball 12.

According to another embodiment an electromagnet may be incorporated into the housing or on top of the housing to apply a magnetic field to prevent relative rotation between the bearings of the races 18 and 20 and the ball 12.

It is noted that the race 18 preferably consists of an annular flat ring with equispaced holes configured to receive roller bearings. Each of the holes are preferably tapered inwardly so that the roller bearings cannot pass all the way through them. In this way the roller bearings protrude beyond the upper and lower faces of the annular ring and are able to contact the upper ring surface of the roller 12 and the lower surface of an upper component of the race 18.

It is also noted that the lower race 20 is held in place by a circlip 23 or a lower skirting device which is able to be screwed into the bottom of the housing 13.

In the second embodiment of the invention shown in Figure 3 an annular housing 30 is provided with a race and bearings 31 enclosing four equispaced rollers 32 each supported from above by an upper race and bearings 34 in a

similar fashion to that shown in Figure 1. A drive shaft 34 is located in the centre of the housing and the roller balls 32 are able to rotate around the shaft 34 but within the confines of the housing and race 30, 31.

5           The internal shaft 34 incorporates teeth 35 and enables either relative rotation of the rollers 32 with respect to the shaft 34 or driven movement when the shaft 34 engages part of an inner central bore 35 through the centre of the housing 30. It follows that this embodiment  
10 has many applications in machinery requiring articulation between different components.

          The third embodiment of the invention shown in Figure 4 consists of a generally spherical housing having an upper hemisphere and lower hemisphere 42. A spherical  
15 roller 43 is housed inside the housing 40 and has an axial hole 43 diametrically therethrough and extending horizontally in alignment with horizontal holes through the equatorial region 44 of the housing 40. The housing  
20 40 incorporates races and bearings 45, 46 on left and right sides thereof. These races although arranged vertically operate in a similar fashion to races and bearings 18 and 20 of the first embodiment of the invention.

          A shaft extends through the central bore 43 and  
25 holes 44 and is provided with pedals on either end.

          At the top and bottom of the housing, braking mechanisms 47, 48 extend through vertical shafts in the housing 40. The braking mechanisms 47, 48 operate in a similar fashion to the braking mechanism 21 shown in  
30 Figure 1. A force applied downwardly to braking mechanism 47 or upwardly to braking mechanism 48 applies a braking force to the ball 39 and the amount of braking force can be adjusted to increase or decrease the ease with which the ball 39 can rotate due to a pedaling action applied to  
35 each of the pedals (not shown).

          From the above it can be seen that the device shown in Figure 4 may be used in an exercise bicycle to

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control the amount of resistance to rotation of the ball  
39.

The device may also be modified to that shown in  
Figure 5 in which the ball is replaced by a cylindrical  
5 bearing 50 located within housing 51. In this Figure a  
single braking mechanism 53 is shown which may be operated  
by twisting a knob 55 in the centre of handle bars 54 to  
vary the braking force applied to the cylindrical roller  
bearing 50. Therefore by operating the pedals 52 a person  
10 riding the bicycle machine is able to provide greater or  
lesser resistance to rotate the roller bearing 50.

The principle employed by the embodiment in  
Figures 4 and 5 is equally applicable to other devices  
such as vehicles in which a braking force may be applied  
15 to prevent rotation of wheels, by applying the braking  
force directly to the roller which allows mobility.

It is to be understood that, if any prior art  
publication is referred to herein, such reference does not  
constitute an admission that the publication forms a part  
20 of the common general knowledge in the art, in Australia  
or in any other country.

## CLAIMS

1. A device for providing multi-directional movement comprising a housing having at least one roller located at least partially within the housing, at least one bearing means for supporting a load and configured to couple the at least one roller with the housing whereby at least one roller is able to rotate relative to the housing and a braking means for providing resistance to rotation of the at least one roller.
2. The device as claimed in claim 1 wherein the bearing means comprises a plurality of rollers.
3. The device as claimed in claim 1 including a single roller.
4. The device as claimed in claim 3 wherein the roller is a spherical ball.
5. The device as claimed in any one of the preceding claims wherein the braking means comprises a braking member which is configured to be urged into contact with at least one roller.
6. The device as claimed in any one of the preceding claims wherein the bearing means includes an urging means for urging the braking member in a predetermined direction.
7. The device as claimed in claim 6 wherein the braking member comprises a brake pad.
8. The device as claimed in claim 6 or 7 wherein the at least one bearing means is located substantially above a major portion of the at least one roller.
9. The device as claimed in claim 8 wherein the braking member is located above the bearing means.
10. The device as claimed in claim 9 wherein the braking member is configured to contact a top surface of at least one roller.
11. The device as claimed in claim 10 wherein the braking means is operable to vary the amount of braking force applied to the roller.

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12. The device as claimed in claim 11 wherein the urging means is operable to apply a predetermined force to the braking member.

13. The device as claimed in claim 12 wherein  
5 the urging means comprises a spring.

14. The device as claimed in claim 13 wherein the bearing means comprises a race and a plurality of roller bearings located therein.

15. The device as claimed in claim 14 wherein  
10 the braking member is able to be forced by the urging means through the race into contact with the roller.

16. The device as claimed in claim 15 wherein the urging means comprises a screwable member.

17. The device as claimed in claim 16 wherein the  
15 screwable member extends vertically through a top section of the housing.

18. The device as claimed in claim 17 wherein the housing includes a shank and socket portion for at least one roller.

19. The device as claimed in claim 18 wherein  
20 the screwable member is controlled by a horizontal screw through a side wall of the housing.

20. The device as claimed in claim 19 wherein the housing comprises a tubular portion configured to  
25 receive at least one roller.

21. The device as claimed in claim 20 wherein the tubular portion has a plurality of stepped regions on its inner surface.

22. The device as claimed in any one of the  
30 preceding claims including a centering means for reducing frictional contact between at least one roller and adjacent inner peripheral surface of the housing.

23. The device as claimed in claim 22 wherein the centering means comprises a peripheral race with a  
35 plurality of roller bearings configured to contact a peripheral portion of the roller.

24. The device as claimed in claim 23 including

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a retaining means for retaining the centering means in position around the peripheral portion of the roller.

25. The device as claimed in claim 24 wherein the retaining means comprises a circlip.

5        26. The device as claimed in claim 25 wherein the housing includes a first annular region which houses the centering means.

10       27. The device as claimed in claim 26 wherein the housing includes a second region which houses the bearing means.

28. The device as claimed in claim 27 wherein the second annular region has a smaller radius than the first annular region.

15       29. The device as claimed in claim 28 wherein the top bearing means comprises an annular member having a plurality of openings in which support rollers are located for contacting an upper surface of the or each roller.

20       30. The device as claimed in claim 29 wherein the or each one of the support rollers is adapted to be seated in the openings so that part of their surfaces protrude downwardly beyond the outer lower surface of the annular member.

25       31. The device as claimed in claim 30 wherein the openings each comprise a hole through the annular member which has a diameter which reduces in size to a minimum, which is less than the width of the roller bearing located therein.

30       32. The device as claimed in claim 31 wherein the housing has a vertical shaft through which the urging member is located.

33. The device as claimed in claim 32 wherein the housing comprises a socket with an elongate portion extending axially from its top surface and the roller is located in its open bottom surface.

35       34. The device as claimed in claim 1 comprising a plurality of rollers each having one bearing means.

35. The device as claimed in claim 1 including

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a central power transfer means with roller equispaced therearound.

36. The device as claimed in claim 1 including a peripheral race with bearings which are configured to contact outer surfaces of the rollers.

37. The device as claimed in claim 36 wherein the central power transfer means comprises a drive shaft.

38. The device as claimed in claim 1 wherein the roller is able to move in any direction.

39. The device as claimed in claim 1 including a plurality of bearing means.

40. The device as claimed in claim 39 including left and right side bearing means.

41. The device as claimed in claim 40 including left and right side centering means located on opposite sides of at least one roller.



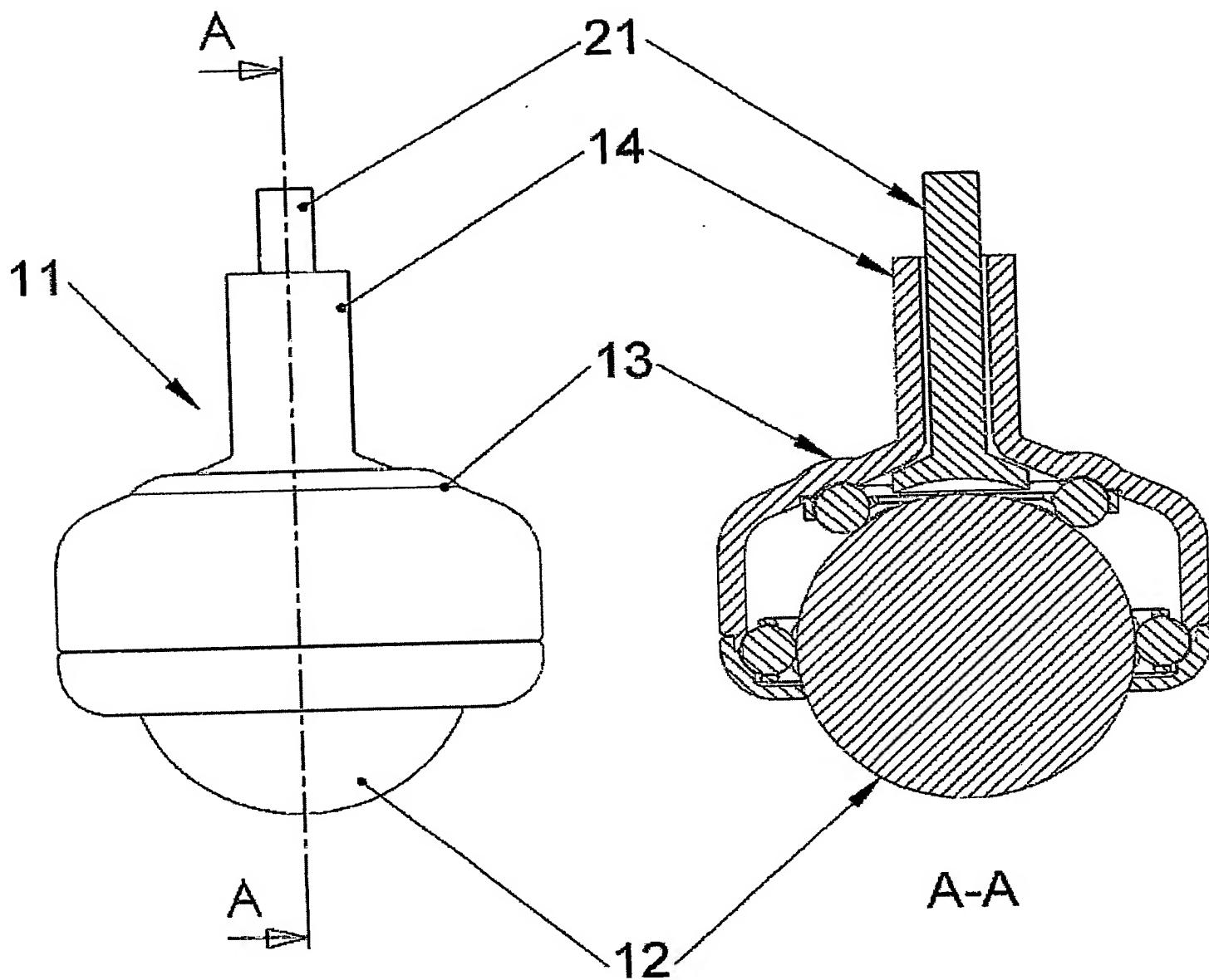
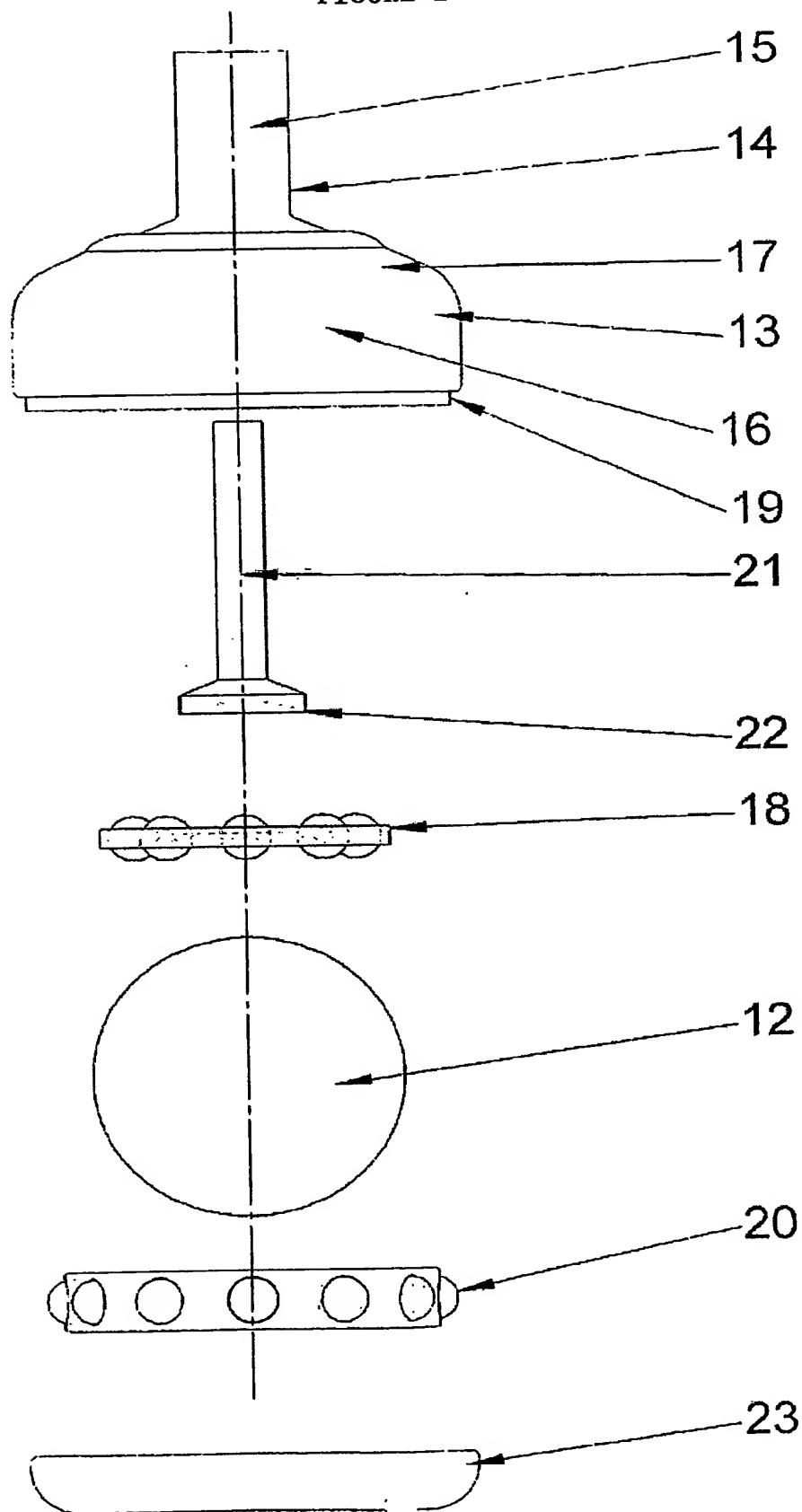


FIGURE 1

FIGURE 2



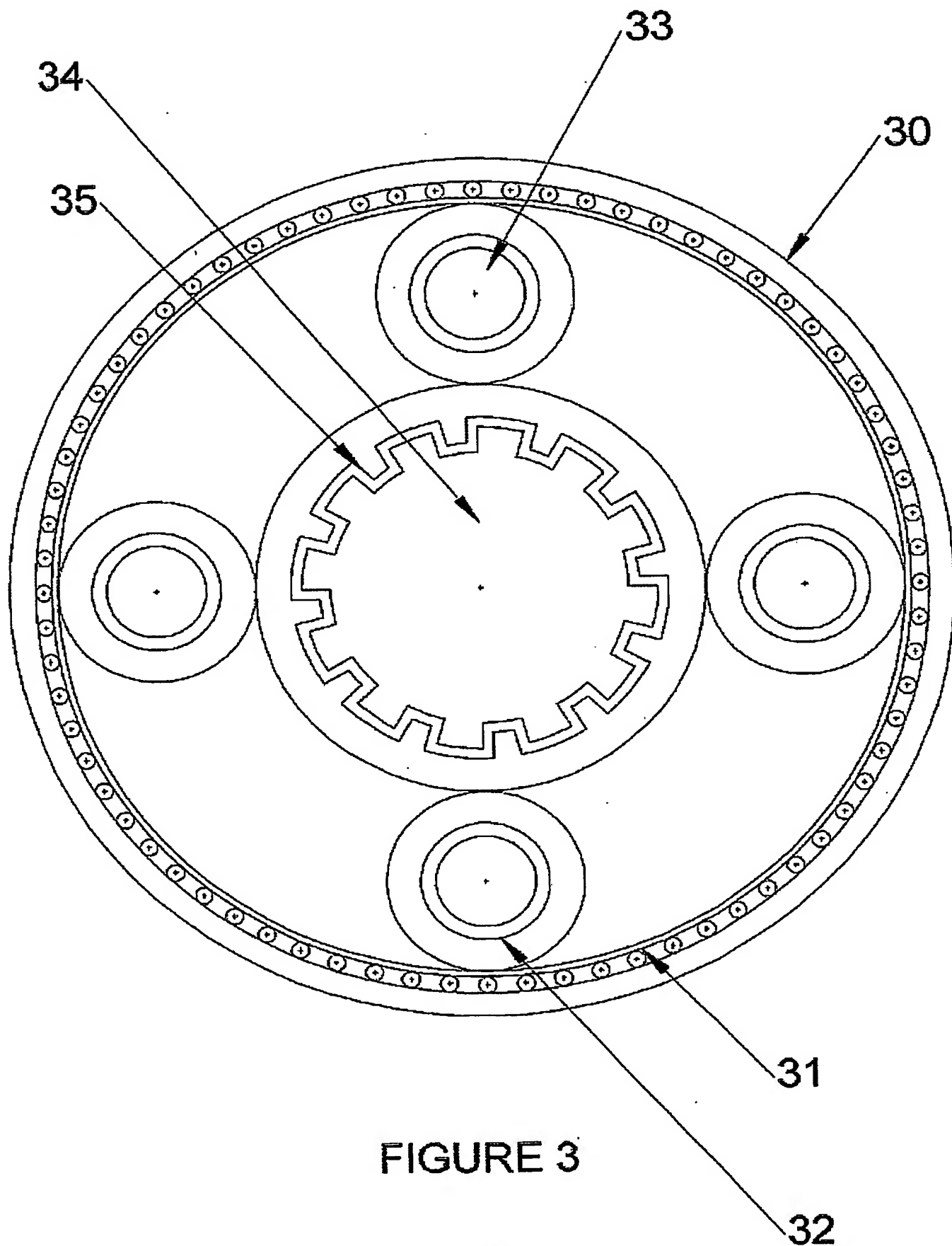


FIGURE 3

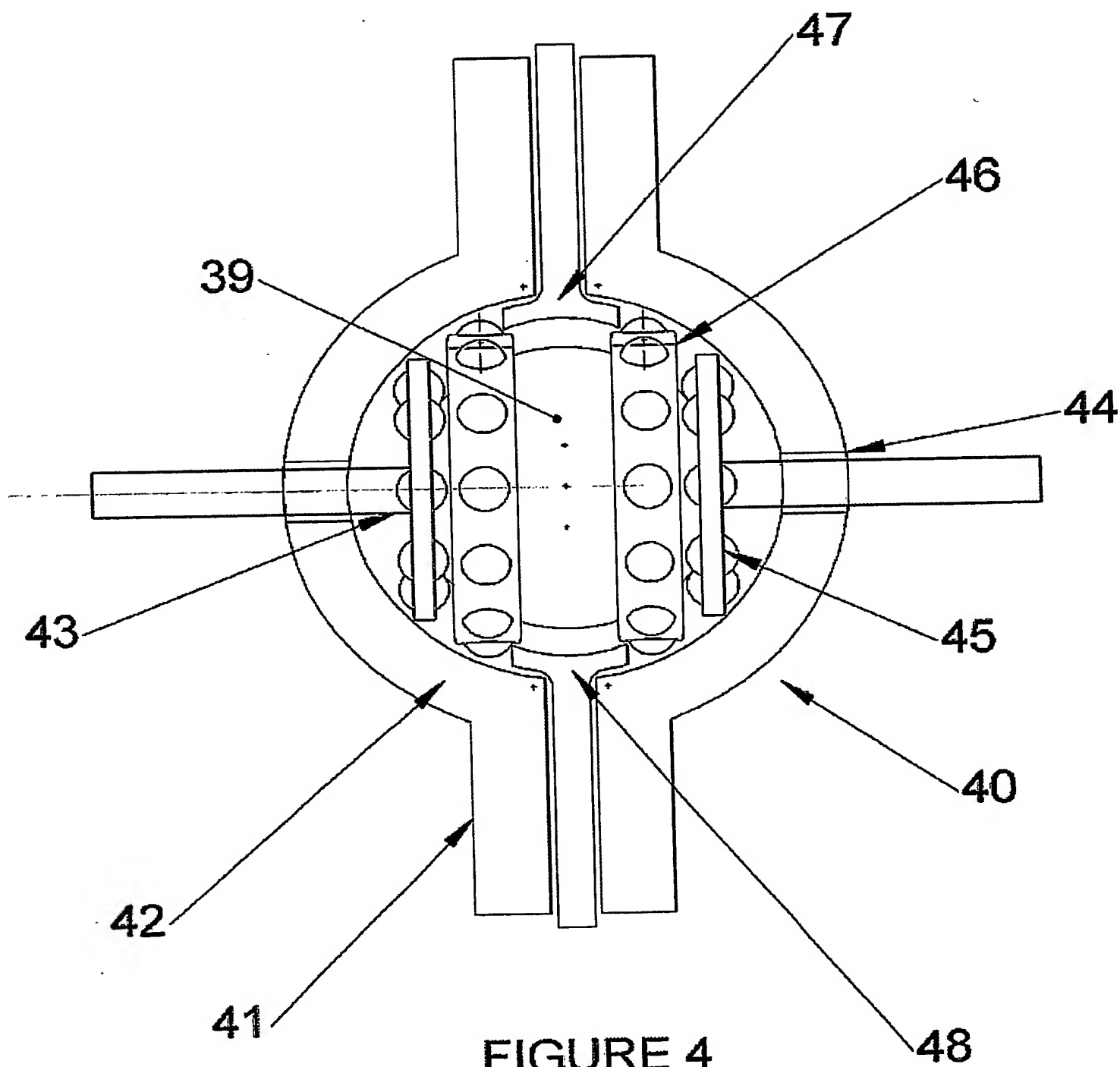


FIGURE 4

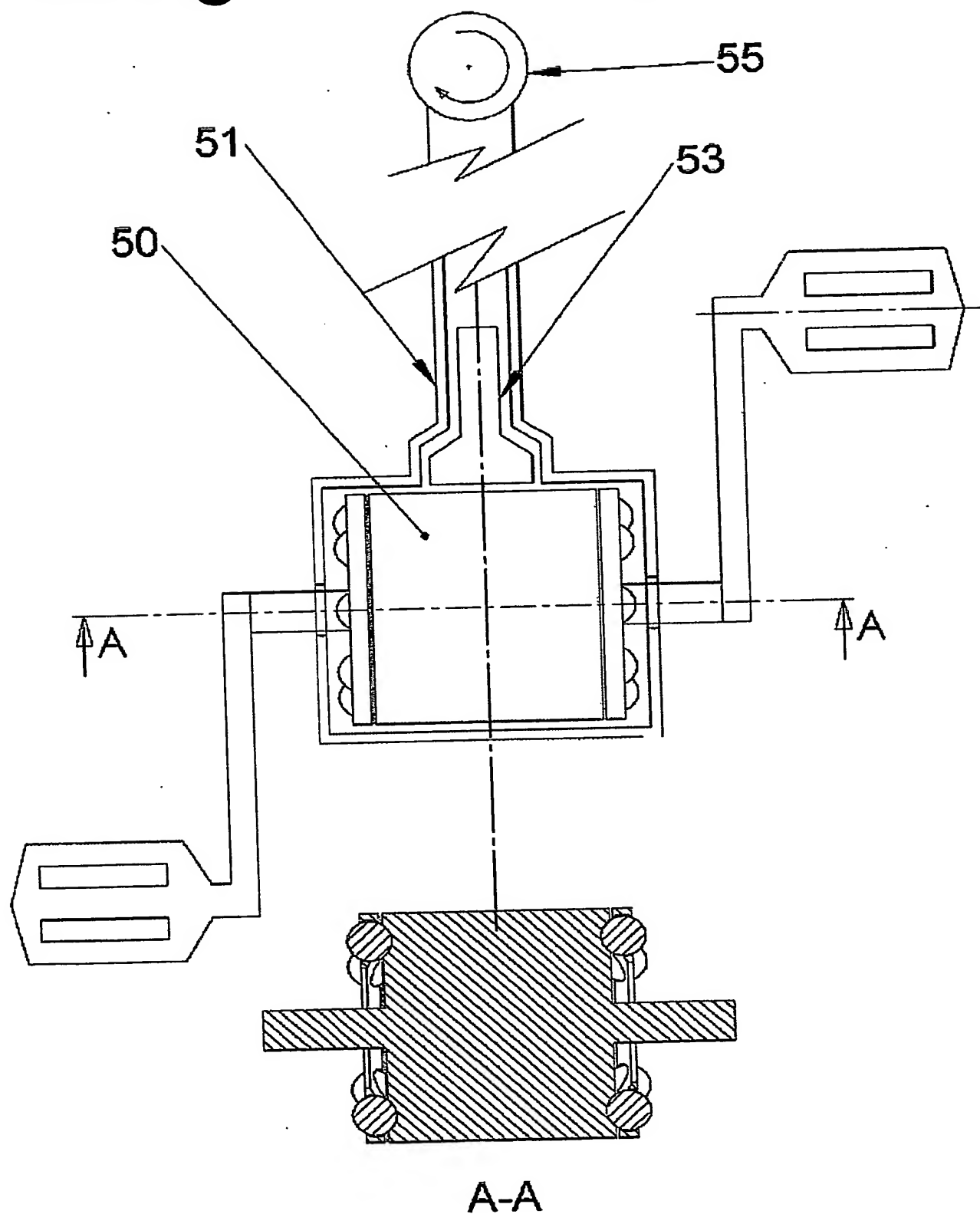


FIGURE 5

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU03/01054

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. <sup>7</sup>: B60B 33/08, A63B 22/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
Refer to electronic data bases consulted below.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
AU: IPC B60B 33/08

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Derwent World Patent Index and esp@ce and USPTO Internet sites: IPC B60B 33/08, A63B 22/- and keywords: brake, retard, stop, shaft, axle, roller, resist, load, and similar terms. US CCL/16/26

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2687546 A (OPPENHEIMER) 31 August 1954 See whole document.	1-15, 22, 34, 38-41
X	US 4402108 A (PANNWITZ) 6 September 1983 See Fig 6 and line 12 of column 6 to line 3 of column 7.	1-18, 22-28, 34, 36, 38-41
X Y	US 600172 A (RECHTSTEINER) 8 March 1898 See Fig 4 and lines 5-14 of page 2.	1-5, 22, 34, 38 23-31

☒ Further documents are listed in the continuation of Box C

☒ See patent family annex

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
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Date of the actual completion of the international search  
9 September 2003

Date of mailing of the international search report 13 SEP 2003

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/AU03/01054

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	AU 5084/46 (128070) B (UVCHEN) 28 November 1946 See whole document.	23-31
X	US 5950749 A (INOUE) 14 September 1999	1-4, 22, 34-35, 38-41
A	US 3848870 A (CRAIG) 19 November 1974 See Figs 6-7.	

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU03/01054

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
US	5950749	DE 1980403	FR 2758515 JP 10201794
END OF ANNEX			